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line 4 from end, interchange *grande* and *petite*; page 169, lines 5 and 6, interchange *sinus* and *cosinus*; page 183, line 4 of the note, for *qualité* read *quantité;* page 266, line 11, for *aa, bb, cc,* read *a, b, c;* page 406, last and 4th from last lines, interchange *maximum* and *minimum;* and similarly on page 522, where in the last line the inequality signs should be reversed; vol. II, page 56, the figure should be numbered 245.

None of these minor blemishes, however, can affect the final judgment of the work, which is that through its clear presentation and discriminating evaluation of so many of the most important topics in the whole field of mathematics, as well as through its stimulation to further thought and investigation along all lines, this book is a really great contribution to mathematical literature, which should be in the possession of every teacher.

R. B. McClenon.

Tables of the Exponential Function and of the Circular Sine and Cosine to Radian Argument. By C. E. Van Orstrand. (*Memoirs of the National Academy of Sciences,* volume 14, fifth memoir.) Washington, D. C., 1921. 4to. 79 pp.

Mr. Van Orstrand, a physical geologist of the U. S. Geological Survey, and a charter member of the Association, has once more rendered fine service to workers in certain fields of applied mathematics. In 1909 he collaborated with G. F. Becker in publishing the 360 page volume, *Hyperbolic Functions* (Smithsonian Mathematical Tables). He has now published fourteen tables concerning which some preliminary publications appeared in *Journal of the Washington Academy of Sciences*, 1912–13. The tables are as follows:

I: Values of the reciprocal of $n!$ to 108 places of decimals at intervals of unity from 1 to 74; II: Values of e^x to 42 significant figures at intervals of unity from 0 to 100; III: Values of e^x to 33 significant figures at intervals of 0.1 from 0.0 to 50.0; IV: Values of e^x to 62 places of decimals at decimal intervals from 1×10^{-14} to 9×10^{-1}; V: Values of e^{-x} ranging from 52 to 62 places of decimals at intervals of unity from 0 to 100; VI: Values of e^{-x} ranging from 33 to 48 places of decimals at intervals of 0.1 from 0.0 to 50.0; VII: Values of e^{-x} to 62 places of decimals at decimal intervals from 1×10^{-10} to 9×10^{-1}; VIII: Values of $e^{\pm(n\pi/360)}$ to 23 places of decimals or significant figures at intervals of unity from $n = 0$ to $n = 360$; IX: Values of $e^{\pm n\pi}$ to 25 places of decimals or significant figures for various values of n; X: Values of $\sin x$ and $\cos x$ to 23 places of decimals at intervals of unity from 0 to 100; XI: Values of $\sin x$ and $\cos x$ to 23 places of decimals at intervals of 0.1 from 0.0 to 10.0; XII: Values of $\sin x$ and $\cos x$ to 23 places of decimals at intervals of 0.001 from 0.000 to 1.600; XIII: Values of $\sin x$ and $\cos x$ to 25 places of decimals at decimal intervals from 1×10^{-10} to 9×10^{-4}; XIV: Miscellaneous values of e^x, e^{-x}, $\sin x$ and $\cos x$ to a great number of decimals, including Boorman's value of e.

In preparing such tables the author sought not only to obtain "a few high place values at sufficiently small intervals of argument for general use in the evaluation of integrals and other functions," but also to obtain "a basis for

subsequent interpolation to small intervals of argument for use in the construction of complete 10-place tables which are applicable in the various fields of pure and applied mathematics."

The author remarks that the most important tables of extended values of the exponential function in which the exponents are integers or fractions were those constructed by Schulze (1778), Bretschneider (1843), Newman (1883, 1889), Gram (1884), Glaisher (1883), and Burgess (1900). The extent of the contribution of each is indicated. There is no reference to Salomon's *Tafeln*, 1827, where the values of e^n, $e^{\cdot n}$, $e^{\cdot 0n}$, $\cdots$ $e^{\cdot 000000n}$, for $n = 1, 2, 3, \cdots 9$, may be found.

The only previous table of the reciprocal of $n!$ seems to have been the one by Glaisher,[1] in 1877, to twenty-eight figures as far as $n = 50$. Mr. Van Orstrand shows that Galisher's table is in error, by one unit, in the twenty-eighth figure of each of the numbers $n = 20, 27, 41, 50$. An elaborate table of $\log_{10} n!$ from $n = 1$ to $n = 1200$ to eighteen places[2] was given in C. F. Degen, *Tabularum Enneas*, Copenhagen, 1824.

In Table IX the values of $e^{n\pi}$ are given for the following sixty values of n: $\pm$ 7/6, $\pm$ 13/6, $\pm$ 19/6, $\pm$ 5/4, $\pm$ 9/4, $\pm$ 13/4, $\pm$ 4/3, $\pm$ 7/3, $\pm$ 10/3, $\pm$ 3/2, $\pm$ 5/2, $\pm$ 7/2, $\pm$ 5/3, $\pm$ 8/3, $\pm$ 11/3, $\pm$ 7/4, $\pm$ 11/4, $\pm$ 15/4, $\pm$ 11/6, $\pm$ 17/6, $\pm$ 23/6, $\pm$ 2, $\pm$ 3, $\pm$ 4, $\pm$ 5, $\pm$ 6, $\pm$ 7, $\pm$ 8, $\pm$ 9, $\pm$ 10. Three of these, namely for n equal to $-$ 9/4, $-$ 4, and $-$ 9, are included in the seventeen values of $e^{n\pi}$ (or $2e^{n\pi}$) given in this MONTHLY, *1921*, 115–120. On page 11 of his introduction Mr. Van Orstrand remarks that "The value of $e^{\pi/2}$ given by Gauss is incorrect in the twenty-third and following decimals"; this error seems to have been first pointed out in this MONTHLY, *1921*, 120.

In table XIV is included (except for one error[3]) the value of e to 346 places of decimals published by J. M. Boorman, "consultative mechanician and attorney at law, Brooklyn, N. Y.," in *Mathematical Magazine*, Washington, August, 1887; it is here pointed out that Shanks's computation of e (1854) to 205 places was incorrect beginning with the 188th decimal. Mr. Van Orstrand states that Tichánek and Minks verified (1892) Boorman's value of e to 223 decimal places, giving as authority *Jahrbuch über die Fortschritte der Mathematik*, volume 23, p. 441 and volume 25, p. 736. A comparison of the numbers shows that they differ in the forty-third decimal place; at that place Boorman gives (correctly) "0" and not "6."

R. C. ARCHIBALD.

April 29, 1921.

The Copernicus of Antiquity (Aristarchus of Samos). By T. L. HEATH. (Pioneers of Progress, Men of Science.) London, Society for Promoting Christian Knowledge, 1920. 4 + 59 pages. Price 2 shillings.

[1] *Cambridge Philosophical Society Transactions*, vol. 13, pp. 246–247.

[2] De Morgan gave a six-place abridgment in his article on "Theory of Probabilities" in *Encyclopedia Metropolitana*, 1837.

[3] Mr. Van Orstrand gives "0" instead of "6" in the thirty-second decimal place. This error may be verified by the computations of Shanks (*l.c.*) and of Glaisher (*l.c.*).